PTO 06-3446

CY=DE DATE=19970828 KIND=A1
PN=196 06 433

METHOD AND DEVICE FOR INJECTING SUBSTANCES UNDER PRESSURE OF A GASEOUS OR LIQUID PRESSURE MEDIUM INTO A SKIN AREA TO BE TREATED

[Verfahren und Vorrichtung zum Einbringen von Substanzen unter Druck eines gasförmigen oder flüssigen Druckmittels in eine zu behandelnde Hautstelle]

L. Bode, et al.

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. April 2006

Translated by: FLS, Inc.

PUBLICATION COUNTRY	(10):	DE
DOCUMENT NUMBER	(11):	19606433
DOCUMENT KIND	(12):	A1
	(13):	Application
PUBLICATION DATE	(43):	19970828
PUBLICATION DATE	(45):	
APPLICATION NUMBER	(21):	19606433.3
APPLICATION DATE	(22):	19960222
ADDITION TO	(61):	
INTERNATIONAL CLASSIFICATION	(51):	A61M 5/30
DOMESTIC CLASSIFICATION	(52):	
PRIORITY COUNTRY	(33):	
PRIORITY NUMBER	(31):	
PRIORITY DATE	(32):	
INVENTOR	(72):	Bode, L.; Martin, J.; Rahn, G.
APPLICANT	(71):	Bode, L.
TITLE	(54):	METHOD AND DEVICE FOR INJECTING SUBSTANCES UNDER PRESSURE OF A GASEOUS OR LIQUID PRESSURE MEDIUM INTO A SKIN AREA TO BE TREATED
FOREIGN TITLE	[54A]:	Verfahren und Vorrichtung zum Einbringen von Substanzen unter Druck eines gasförmigen oder flüssigen Druckmittels in eine zu behandelnde Hautstelle

Description /1*

This invention relates to a method for applying substances, in particular pharmaceuticals or cosmetics, in solid, liquid, or gaseous form to a skin area that is to be treated, a pressure injection device for implementing said method, an a manually actuatable treatment device that is suitable for use in the pressure injection device.

In cosmetic care it is common to apply and, depending on the application, more or less intensively to rub into human skin, in particular, a body lotion or a variety of cremes, on the outer cell layer of the skin, the so-called epidermis. The active ingredients of the applied lotion or creme are, in part, rubbed directly into the cell layer or diffused into it slowly. Moreover, in both the fields of cosmetics and medicine techniques are used with which the cosmetics or pharmaceuticals are sprayed onto the skin surface that is to be treated. These treatment techniques have the disadvantage that the substances that are applied and rubbed in or sprayed on the skin surface diffuse only partially into the epidermis. The remainder evaporates into the surroundings. Moreover, it is known that, in the areas of therapeutics and diagnostics, the pharmaceuticals can be injected directly into the skin by means of a hypodermic syringe.

---

* Numbers in the margin indicate pagination in the foreign text.

However, the method of injection by needle frequently gives patients an unpleasant and uneasy feeling.

Thus, the object of this invention is to make available a method, a device, and a treatment instrument, with which pharmaceuticals or cosmetics can be applied in a relatively simple manner that is more efficient than conventional application of the substances to the skin surface in a skin area that is to be treated, without having to subject the person being treated to a higher level of stress, as occurs when hypodermic syringes are used.

This technical problem is solved in accordance with the invention by using the method steps of Claim 1 and the characteristics of Claim 9 and Claim 17.

The essence of the invention is that a substance, in particular a pharmaceutical or cosmetic in solid, liquid, or gaseous form is applied to a predetermined skin area under a predetermined, adjustable pressure by a jet that can be placed on the skin surface that is being treated. For example, the substance can be applied under various pressures to the facial skin, in particular to problem areas such as around the eyes, nose, and mouth, and on any desire parts of the body that, for cosmetic and medical reasons, may need care.

For this purpose, the present invention provides a pressure-injection device. The term "pressure injection" found throughout this material is used to distinguish it from conventional injection

techniques, which are based on the used of hypodermic syringes. For the purposes of this invention, pressure injection means that substances, in particular pharmaceuticals and cosmetics, are brought into the epidermis, or stated more properly, pressed in, in such a way that a predetermined pressure is applied to the skin surface.

The pressure injection device has a device for supplying a gaseous or liquid pressure medium under a predetermined, adjustable pressure. Preferably, oxygen is used as a gaseous pressure medium. This device, subsequently referred to a pressure medium supply device, comprises a pressure medium container and at least one pressure medium connection, to which an electrically controllable shut-off valve and a pressure reducer, delivering a predetermined, adjustable pressure to the output, are connected. A manually or automatically actuated treatment instrument is used in the form of a at least one so-called applicator, on which a jet, which may be placed on the skin area to be treated, is replaceably and removably attached or integrally connected. In order to bring a substance into a certain skin area, the jet is placed on the skin surface that is to be treated. The treatment device (also called treatment instrument or applicator) is connected to the pressure container by a pressure medium connection. In the preferably manually actuated treatment instrument or applicator there is a feed channel, which can be connected to the pressure medium supply device. The jet is arranged at one end of the feed channel, terminating the latter. An

electrically controllable shut-off valve in the treatment instrument opens or closes the connection with the jet. Because of the shut-off valve in the treatment instrument, in the resting state of the device the pressure medium can escape only in the section between the shut-off valve of the treatment instrument and the jet. Otherwise, i.e. in particular in the pressure medium connection between the pressure container and the treatment instrument, the working pressure is maintained. This provides a short system response time. The response time of the pressure injection device is shorter, the closer the shut-off valve is to the jet.

Of course, the jet in the treatment instrument can have any desired cross section, by the jet preferably expands in a funnel shape in the direction of flow of the pressure medium, whereby the inner diameter of the jet increases from approximately 0.5 mm to approximately 12 mm. The opening angle of the funnel is expediently less than. Preferably, the inner diameter on the end face of the jet is in the range of 0.5 to 12 mm. Moreover, a circumferential groove can be made in the end face of the jet, in which a sealing ring is placed. When the jet is placed on the skin surface, this essentially prevents the pressure medium from escaping laterally between the jet and the skin surface when pressure is applied to the skin surface.

The treatment instrument is further characterized by a housing-shaped head part, which contains the feed channel. A chamber that is closed on all sides can be provided, which is connected by a flow

connection, in particular a hose, to the end of the feed channel opposite the jet. The chamber has an inlet connection, to which the pressure medium supply device can be connected. In this exemplary embodiment, the electrically controllable shut-off valve is arranged in the chamber, in order to open and close the flow connection to the feed channel and, thus, to the jet. The flow connection and the /2
electrically controllable shut-off valve are arranged in the chamber in such a way as to divided the chamber into a front chamber section and in a rear chamber section, remote from the jet. The rear chamber section contains the inlet connection and an inlet bore, through which the substance can be fed in. Thus, the rear chamber can also serve as a mixing chamber, in which the substance that is to be brought into the skin surface can be mixed with the pressure medium. In the head part are an actuating element, accessible from the outside, for starting the treatment, and a display device, which among other things can display the operating state of the treatment device. The substance that is to be brought into the skin surface can be applied to the skin surface, for example, immediately before application of the treatment instrument or, as mentioned above, it can be mixed with the pressure medium in the rear chamber. Alternatively, a storage tank can be arranged in the vicinity of the jet, from which the pressure medium flowing through the feed channel can carry with it the required amount of substance at the time the electrically controllable shut-off valve is switched.

The head part and the feed channel formed in it are preferably made as a one-piece injection molded part, to which the chamber can be rigidly attached. It is also possible for the jet to be removeably attached to the head part or made in one piece with the latter.

In the end of the feed channel facing away from the jet is a connector that is connected by a hose to a connector in the chamber, which cooperates with the shut-off valve.

A plurality of treatment devices can be connected in parallel to the pressure medium container of the pressure medium supply device, each via a separate pressure medium connection. An electrically controllable shut-off valve and/or a pressure reducer, each producing a different pressure, can be placed in each pressure medium connection. Four treatment instruments are advantageously connected in parallel via appropriate pressure medium connections to the pressure medium container. The pressure reducers in each pressure medium connection deliver an output pressure of 3, 4, 5, and 6 bar, respectively. The pressure reducers can be made in such a way that they are continuously variable between 0 and 8 bar. The different pressures are suitable for treating different parts of the body, e.g., the skin around the eyes, facial skin, soft tissue, and other skin areas of the body. An additional electrically controllable shut-off valve and/or a pressure reducer, which preferably delivers an output pressure of 8 bar, can be placed before the parallel pressure reducers. At this point, it should be pointed out that the

combination of an electrically controllable shut-off valve and a pressure reducer can optionally be implemented by a single, correspondingly designed valve. In order to monitor the working pressure applied to each treatment instrument, the pressure medium connections are each connected via an electrically controllable shut-off valve to a common pressure sensor; they can also be monitored by separate pressure sensors. The pressure of the pressure container is determined by a separate pressure sensor.

In order to determine a pressure drop at the jet occurring, for example, when pressure medium escapes between the jet and the skin surface, each pressure medium connection has a choke, which provides a constant flow.

A microprocessor-control device has the task, for example, of monitoring the pressure sensors and controlling the electrically controllable shut-off valves and pressure reducers. The electrically controllable shut-off valves are preferably magnetic valves, which are controllable by drivers. A display device, such as an LCD display, and additional LED light displays show the operating states of the pressure injection device. All control parameters, pressure values, and treatment times needed for operating the pressure injection device are placed in a storage device. Moreover, a keyboard is provided for inputting the required data and control information.

A device for density modulation of the pressure medium, e.g., in the form of a piezoelectric converter, is expediently provided, which

can modulate the essentially static pressure of the pressure medium in a pulsed manner. The density modulations device is advantageously arranged in the applicator between the electrically controllable shut-off valve and the jet and communicates with the feed channel. This assures that the modulated pressure is applied to the jet almost undiminished.

With this invention, it is possible to insert pharmaceuticals or cosmetics, in a manner gentle to the skin and with a high efficiency, into the epidermis of a patient at a predetermined place, without frightening the patient, as is the case, for example, with conventional injection syringe techniques.

The invention will be described in greater detail below with the help of an exemplary embodiment, with reference to the drawings. The figures show:

Figure 1: a simplified electrical block diagram of the inventive pressure injection device with four treatment instruments in accordance with this invention,

Figure 2: a simplified schematic diagram of a plurality of functional units of the pressure medium supply device shown in Fig. 1.

Figure 3: a detailed representation of an inventive treatment instrument as in Fig. 1 or 2,

Figure 4: an exemplary embodiment of a device for density modulation of the pressure medium, which can be arranged in an applicator as in Fig. 3, and

Figure 5: an alternative exemplary embodiment of a device for density modulation of the pressure medium, which can be arranged in an applicator as in Fig. 3.

Figure 1 shows in simplified form the basic design of a pressure injection device, designated in its entirety by the reference number 10, which may be fixed or mobile. As will be described in greater detail below, pressure injection device **10** brings substances, in particular pharmaceuticals or cosmetics in solid, liquid, or gaseous form, into the epidermis at a predetermined location on of human or animal body, under a predetermined, adjustable pressure. As the term "pressure injection device" itself indicates, no hypodermic syringe, but rather a liquid or gaseous pressure medium is used as the working means. One aspect, which will be considered preferable below, /3 makes it possible to view pressure injection device **10** as a device that comprises a pressure medium supply device **15** and at least one treatment device **100**. Figure 1 shows a total of four treatment devices **100**, **230**, **280** and **330**, which are also designated treatment instruments or applicators in the present publication. Pressure medium supply device **15** has an oxygen cylinder as a pressure medium container **20**. Of course, pressure medium containers **20** can be used that, in addition to other gaseous pressure media, also provide

liquid pressure media. Connected to the output of oxygen cylinder **20** is a mechanical shut-off valve **30**, which blocks or releases the outflow of oxygen. Mechanical shut-off valve **30** is followed successively by a pressure sensor **40**, a pressure reducer **50**, and an electrically controllable shut-off valve **60**. Pressure sensor **40** is, for example, a manometer that can measure pressures up to 200 bar. Pressure reducer **50** is capable of delivering an output pressure of 8 bar. Pressure medium supply device **15** further comprises four pressure medium connections **90**, **220**, **270**, **320**, all of which may be made, for example, in the form of hoses. Pressure medium connections **90**, **220**, **270**, **320** are connected in parallel to oxygen cylinder **20** and connect applicator **100**, applicator **230**, applicator **270**, and applicator **330** to oxygen cylinder **20**. As also seen in Fig. 1, each pressure medium connection contains an electrically controllable shut-off valve and a pressure reducer. In particular, pressure medium connection **90** contains, for example, an adjustable pressure reducer **80**, which can deliver an output pressure of 3 bar, and an electrically controllable valve **70** in the form of a magnetic valve. Pressure medium connection **220** contains, for example, an adjustable pressure reducer **210**, which can deliver an output pressure of 4 bar, and an electrically controllable magnetic valve **200**. Pressure medium connection **270** contains an adjustable pressure reducer **260**, which can deliver an output pressure of 5 bar, and an electrically controllable magnetic valve **250**. In fourth and final pressure medium connection **320**, there

is a pressure reducer **310**, which can deliver an output pressure of 6 bar, and an electrically controllable magnetic valve **300**. These pressures are applied to applicator **100**, applicator **230**, applicator **280**, and applicator **330**, respectively. Of course, the pressure reducers can be made in such a way that the output pressure is adjustable between 0 and 8 bar. As shown in Fig. 1 and, in particular, in Fig. 3, each applicator **100**, **230**, **280**, **330** can have an electrically controllable magnetic valve **110**, **240**, **290**, or **340**. The shut-off valve in each applicator makes sure that, in the resting state or in the stand-by state of pressure injection device **10**, the working pressure produced by the respective pressure reducer is maintained up to the shut-off valve in the respective applicator. As will be described in greater detail below, the response time of the pressure injection device and, thus, the treatment interval, can be reduced in this way. In Fig. 1 four applicators **100**, **230**, **280**, and **330** are connected to oxygen cylinder **20** via the respective pressure medium connections **90**, **220**, **270**, and **320**. It is possible, however, to use a single pressure medium connection and a single applicator. In this case, pressure reducer **50** can be made in such a way that it can continuously deliver an output pressure of 0 to 8 bar and, in particular, the discrete output pressures of **3**, **4**, **5**, and 6 bar. Moreover, it is possible, instead of four applicators, to connect any number of applicators in parallel to oxygen cylinder **20**. In the present exemplary embodiment in accordance with Fig. 1, applicator

100 serves, for example, to apply pharmaceuticals under a pressure of approximately 3 bar to the skin surrounding the eyes. Applicator **230** delivers pharmaceuticals or cosmetics under a pressure of approximately 4 bar to the facial skin. With applicator **270**, pharmaceuticals or cosmetics can be delivered under a pressure of approximately 5 bar to the neck and breast region. A working pressure of approximately 6 bar is applied to applicator **330**, with which pharmaceuticals or cosmetics can be delivered to the remaining parts of the body. As seen in Fig. 1, a single pressure sensor **390** is provided, which is connected via four connecting lines to pressure medium connections **90**, **220**, **270**, and **320**. So that the pressure can be measured separately in each pressure medium connection, each connecting line has an electrically controllable magnetic valve **350**, **360**, **370**, or **380**. Pressure sensor **390** is designed in such a way that it can indicated pressures up to 10 bar. It is possible, of course, for each pressure medium connection or each applicator to be associated with its own pressure sensor. For reasons of cost, however, the implementation shown in Fig. 1 will probably be used. Between the respective applicator and the associated pressure reducer, each pressure medium connection **90**, **220**, **270**, and **320** can have a throttle **85**, **215**, **265**, or **315**, with which the flow rate of the pressure medium can be limited to a predetermined amount. The throttles make sure there is a constant flow to jet **135**, even when pressure medium escapes, due to an improperly mounted jet. In this

case, the preset working pressure can no longer be achieved and microprocessor **440**, which monitors pressure sensor **390**, reports a pressure drop.

Figure 2 shows a highly simplified, electrical block diagram with several functional blocks of the pressure injection device shown in Fig. 1. Pressure injection device **10** shown in Fig. 1 typically has a plug connection **24** and a surge-protected power supply **400**. In addition, there is a display device **410**, which in addition to an LCD display also has a plurality of LED light displays. Among other things, display **410** indicates the pressures measured by pressure sensor **390** and pressure sensor **40** in the respective pressure medium connections **90**, **220**, **270**, and **320**. Moreover, the operating states of the respective applicators **100**, **230**, **280**, and **330** can be displayed. A microprocessor **440** monitors pressure sensors **40** and **390**. Applicators **100**, **230**, **280**, **330** and magnetic valves **110**, **240**, **290**, **340** arranged in the applicators are also monitored by microprocessor **440** and they are controlled for orderly operation of device **10**. Magnetic valves **110**, **240**, **290**, and **340** are controlled by drivers **430**, which are connected to microprocessor **440**. In addition to the required pressures, keyboard **460** can be used to enter the respective treatment time, i.e., the time during which the applicator is to be placed on the skin surface being treated. The treatment time advantageously lies between 0.1 and 2 s. A storage device **450** can be provided, in which /4

all required parameters and control data, which are entered via keyboard **460**, can be stored.

We now refer to Fig. 3. It shows applicator **100** of Fig. 1 in greater detail. In this example, applicator **100** is presented as a manually actuated treatment instrument, which may be moved to any part of the body. It is also possible, of course, to connect the applicators to a processor-controlled robot, in the form of an automated treatment instrument. Applicator **100** shown in Fig. 3 has a front part or head part **115** and a rear part **120**, which is made in the form of a chamber that is closed on all sides. Head part **115** has an essentially rectangular cross section, which narrows in the front, i.e., in the direction of the jet, ending in a narrow, beak-like end piece **132**. Head part **115** contains a rectangular cavity **125**, in which an actuating element **127** and a plurality of display devices **128**, for example in the form of LEDs, are placed. Both LEDs **128** and actuating element **127** can be electrically connected to microprocessor **440**. The treatment may be started with actuating element **127**. If actuating element **127** is pressed, microprocessor **440** actuates electrically controllable magnetic valve **110**, thereby applying the working pressure of 3 bar to the jet via the pressure medium. In the lower half of head part **115** is a feed channel **130**, which extends over the entire length of head part **115**. Head part **115** and feed channel **130** are advantageously made in the form of a one-piece injection molded part. A jet **135** is attached to beak-like end **132** of head part **115**.

Jet **135** is either an integral component of head part **115** or is removably or permanently attached to head part **115**. For example, a connector that partially extends out of feed channel **130** can be inserted into beak-like end **132** of feed channel **130**. Jet **135** can be placed on this protruding connector. Jet **135** shown in Fig. 3 extends in the shape of an expanding funnel in the direction of a skin surface, which is not shown. The inner diameter of the jet increases, for example, from 0.5 to 12 mm. The end face of jet **135** is flared in the manner of a flange, so that a groove may be made in its periphery. A sealing ring **137** is inserted into this circumferential groove. Sealing ring **137** makes sure that when jet **135** is properly placed on the skin surface that is to be treated no compressed air can escape between the end face and the skin surface. A funnel-shaped, expanding jet **135** is shown, but any desired cross-sectional shape is possible for jet **135**. The inner diameter, for example, of a cylindrical jet **135** is preferably in the range of 0.2 to 12 mm. The cross-sectional area of feed channel **130** is essentially constant and is preferably 1 to 4 mm^2. The rear end of head part **115** is connected to chamber **120**. Chamber **120** is preferably firmly attached to head part **115**. So that the pressure medium supplied from oxygen cylinder **20** can pass through chamber **120** into feed channel **130** to jet **135**, a connector **140**, for example, is inserted into the end of feed channel **130** opposite the jet. An additional connector **142** is arranged in chamber **120** and is connected by a hose **144** to connector **140** in feed

channel **130**. For this purpose, a corresponding bore is provided in a wall **146** of chamber **120** facing head part **115**. Electrically controllable magnetic valve **110** shown in Fig. 1 is also located in chamber **120** and cooperates appropriately with connector **142**. In other words, magnetic valve **110** opens or closes connector **142**. Electrically controllable magnetic valve **110** and connector **142** are arranged in chamber **120** in such a way as to divide chamber **120** into a front chamber **150** and a rear chamber **155**, facing away from head part **115**. Front and rear chambers **150, 155** are preferably hermetically sealed from each other. If this is not the case, then there must be a hermetic seal either between the opening in wall **146** and hose **144** or between the connecting point of head part **115** and chamber **120**. We will assume that front and rear chambers **150, 155** are hermetically separated. An attachment connector **162** is inserted on or made an integral part of rear wall **160** of chamber **120** facing away from head part **115**. Rear wall **160** is expediently made as a separate part and hermetically closes chamber **120** after insertion of electrically controllable shut-off valve **110**. Pressure medium connection **90** is connected to inlet connection **162**. In accordance with an advantageous refinement, an inlet bore **164** can be made in rear wall **160**, to which a storage tank (not shown) for the pharmaceuticals or cosmetics to be injected into the skin can be connected. Instead of applying the substance directly to the skin surface that is to be treated, it is also possible to mix the substance directly with the pressure medium

by inserting it through inlet bore **164** into rear chamber **155**, which in this case serves as a mixing chamber. Alternatively, a storage tank can be arranged in feed channel **130**, in the vicinity of jet **135**. In this case, when shut-off valve **110** opens, the oxygen supplied by oxygen cylinder **20** flows through connector **142**, hose **144**, connector **140**, and feed channel **130**, thereby carrying the proper amount of substance from the storage tank along with it.

Chamber **120** is firmly connected to head part **115**, but it is also possible for chamber **120** to be separate from head part **115**. In this case, a correspondingly long hose connection **144** must be used.

Although the pressure injection device **10** described thus far uses a nearly static working pressure on jet **135** for skin treatment, it is also possible to operate with a dynamic working pressure, i.e., a working pressure with pressure fluctuations. Figure 4 shows an implementation of a density modulator **101**, which is capable of producing pressure fluctuations by density modulation of the pressure medium, expediently a gaseous pressure medium. Density modulator **101** is arranged between shut-off valve **70** and applicator **100**. It is also possible to accommodate pressure or density modulator **101** in the applicator itself. As shown in Fig. 4, density modulator **101** includes an eccentric **106**, which drives pump **104**. A membrane **102**, which is mounted in a hermetically sealed housing, transmits liquid fluctuations to the gaseous pressure medium. Figure 5 shows an /5

alternative density or pressure modulator **108**, which is expediently used with liquid pressure media. This density modulator may be a piezoelectric converter **108** that can be operated up into the ultrasonic region. This density modulator **108** can also be placed in applicator **100**. In another possible embodiment, magnetic valve **110** of applicator **100** can itself be operated with a switching cycle of up to 10 Hz. This switching can be accomplished by microprocessor **440**.

Operation of pressure injection device **10** will be described below, based on applicator **100**. It is assumed that all applicators **100**, **230**, **280**, and **330** are in so-called stand-by mode. In this case, electrically controllable magnetic valves **110**, **240**, **290**, and **340** are closed, while magnetic valves **70**, **200**, **250** and **300** are open. With these valve positions, the respective working pressure is already present in the individual chambers of the respective applicators. Moreover, it is assumed that mechanical shut-off valve **30** is open. Pressure reducer **50** provides a pressure of 8 bar at its output. Optional magnetic valve **60**, which can serve as a redundant safety shut-off valve, is also open, so that an output pressure of 3 bar is applied to pressure reducer **80**. Since electrically controllable shut-off valve **110** in chamber **120** of applicator **100** is closed, oxygen is present under a pressure of 3 bar at input connector **142**. As soon as a physician or other professional presses actuating switch **127**, microprocessor **440** actuates magnetic valve **110**, opening attachment connector **142**. The applied pressure medium flows through hose **144**,

through feed channel **130** to jet **135** which, for example, is placed on the skin surrounding an eye. It is assumed that the salve to be injected has been applied to the skin. The oxygen flows only from shut-off valve **110** to the skin that is closing off jet **135**, so that the working pressure of 3 bar is applied to jet **135**. The substance is then pressed into the skin under this pressure, whereby only a small portion of the oxygen enters the skin surface with the substance. Once the treatment time entered by keyboard **460** has expired, the microprocessor closes shut-off valve **110**. The arrangement of shut-off valve **110** in applicator **100** assures that the working pressure of 3 bar will be maintained directly at attachment connector **142**. The working pressure drops to atmospheric pressure only in hose **144** and feed channel **130**, since the oxygen escapes. Consequently, it is possible to dispense with chamber **120** completely and to arrange electrically controllable shut-off valve **110** as close to jet **135** as possible in feed channel **130**, since the path defined by hose **144** and feed channel **130** determines the response time of pressure injection device **110** and, thus, the treatment cycle. Of course, rear chamber **155** in chamber **120** should have a sufficiently large storage reservoir, so that several treatment cycles can be carried out without first having to open mechanical shut-off valve **30** or electrically controllable shut-off valves **60** and **80** repeatedly.

Claims

1. A method for bringing substances, in particular pharmaceuticals or cosmetics in solid, liquid, or gaseous form, into a skin area that is to be treated, characterized in that the substance is applied under a predetermined adjustable pressure of a gaseous or liquid pressure medium through a jet that can be placed on the skin area that is to be treated.

2. A method as recited in Claim 1, characterized in that the pressure is applied to the skin area that is to be treated for approximately 0.1 to 2 s, whereby the treatment time can be adjusted manually or by processor control.

3. A method as recited in one of the Claims 1 or 2, characterized in that the pressure can be adjusted between 0 and 8 bar.

4. A method as recited in Claim 3, characterized in that the pressure can be adjusted stepwise to 3, 4, 5, and/or 6 bar.

5. A method as recited in one of the Claims 1 through 4, characterized in that the substance is applied to the skin area to be treated before the jet is placed on the skin area.

6. A method as recited in one of the Claims 1 through 4, characterized in that the substance is mixed with the pressure medium.

7. A method as recited in one of the Claims 1 through 6, characterized in oxygen is used as the pressure medium.

8. A method as recited in one of the Claims 1 through 7, characterized in that pressure fluctuations can be superimposed on the essentially static pressure on the jet.

9. A pressure injection device for implementing the method as recited in one of the Claims 1 through 8, characterized by

a) a device (15) for supplying a gaseous or liquid pressure medium at a predetermined, adjustable pressure, having a pressure medium container (20) and at least one pressure medium connection (90), which has an electrically controllable shut-off valve (70) and a pressure reducer (80), delivering a predetermined, adjustable pressure to its output,

b) at least one manually or automatically actuatable treatment device (100; applicator) having a jet (135) that can be placed on the skin area that is to be treated, for bringing a substance into the skin area, whereby treatment device (100) is connected to pressure medium container (20) by pressure medium connection (90).

10. A pressure injection device as recited in Claim 9, characterized in that an electrically controllable shut-off valve (110) is arranged in the or in each treatment device (100).

11. A pressure injection device as recited in Claim 9 or 10, characterized in that jet (135) is removably or not removably attached to treatment device (100) and expands in the manner of a funnel in the direction toward the skin, whereby the inner diameter

of the jet increases from approximately 0.5 mm to approximately 12 mm.

12. A pressure injection device as recited in one of the Claims 9 through 11, characterized in that a plurality of treatment devices (100, 230, 270, 330) are connected in parallel to pressure medium container (20), each via a separate pressure medium connection (90, 220, 270, 320) and that each pressure medium connection (90, 220, 270, 320) has an electrically controllable shut-off valve (70, 200, 250, 300) and/or a pressure reducer (80, 210, 260, 310), each producing a different pressure. /6

13. A pressure injection device as recited in Claim 12, characterized in that four pressure medium connections (90, 220, 270, 330) are connected in parallel to pressure medium container (20) and that pressure reducer (80, 210, 260, 310) in each pressure medium connection (90, 220, 270, 320) delivers an output pressure of 3, 4, 5, or 6 bar.

14. A pressure injection device as recited in Claim 12 or 13, characterized in that parallel pressure reducers (80, 210, 260, 310) are preceded by an electrically controllable shut-off valve (60) and/or a pressure reducer (50), which delivers an output pressure of 8 bar.

15. A pressure injection device as recited in one of the Claims 9 through 14, characterized in that pressure medium connections (90, 220, 270, 320) are each connected via an electrically controllable

shut-off valve (380, 370, 360, 350) to a common pressure sensor (390), or each has a separate pressure sensor, and that an additional pressure sensor (40) measures the pressure of pressure medium container (20).

16. A pressure injection device as recited in one of the Claims 9 through 15, characterized by

a microprocessor control device (440), which monitors pressure sensors (40, 390) and which can control electrically controllable shut-off valves (60, 110, 240, 290, 340; 350-380) and pressure reducer (50, 80, 210, 260, 310),

a display device (410), on which the operating states of pressure injection device (10) can be displayed,

a storage device (450), in which control parameters, pressure values, and treatment times for each treatment device can be stored, and a keyboard (460) for entering the control and parameter information.

17. A pressure injection device as recited in one of the Claims 9 through 16, characterized by a device (102, 104, 106; 108) for density modulation of the pressure medium.

18. A pressure injection device as recited in Claim 17, characterized in that density modulation device (102, 104, 106) comprises a membrane (102), which can be caused to vibrate by a pump (104), which is driven by an eccentric (106).

19. A manually actuatable treatment device for use in the pressure injection device as recited in one of the Claims 9 through 18, characterized by

a feed channel (130) in treatment device (100), which is connected to a pressure medium supply device (15),

a jet (135), which is arranged at one end of feed channel (130) and closes it off,

and an electrically controllable shut-off valve (110), which opens or closes the connection to jet (13).

20. A manually actuatable treatment device as recited in Claim 19, characterized by

a housing-like head part (115), which contains feed channel (130),

a chamber (120) closed on all sides, which is connected via a flow connection (144) to the other end of the feed channel and an inlet connection (162), to which pressure medium supply device (15) can be connected, whereby electrically controllable shut-off valve (110) is arranged in chamber (120) and opens or closes flow connection (142, 144).

21. A manually actuatable treatment device as recited in Claim 20, characterized in that electrically controllable shut-off valve (110) together with flow connection (142, 144) divides chamber (120) into a front chamber section (150) and a rear chamber section (155), which is remote from jet (135), which contains inlet connection (162)

and inlet bore (164), through which a substance, in particular a pharmaceutical or cosmetic, can be introduced.

22. A manually actuatable treatment device as recited in Claim 20 or 21, characterized in that is head part (115) contains an outwardly accessible actuating element (127) for starting the treatment and a display device (128), which indicates the operating state of treatment device (100).

23. A manually actuatable treatment device as recited in one of the Claims 20 through 22, characterized in that a storage tank for the substances is arranged in the front end of head part (115), in the vicinity of insertable jet (135).

24. A manually actuatable treatment device as recited in one of the Claims 19 through 23, characterized in that the inner diameter of jet (135) can be 0.5 to 12 mm.

25. A manually actuatable treatment device as recited in one of the Claims 19 through 24, characterized in that jet (135) opens in the direction of the skin that is to be treated in the manner of a funnel, having an opening angle that is less than 180°.

26. A manually actuatable treatment device as recited in Claim 25, characterized in that the inner diameter of funnel-like jet (135) constantly increases from approximately 0.5 mm to approximately 12 mm.

27. A manually actuatable treatment device as recited in one of the Claims 19 through 26, characterized in that a circumferential

groove is made in the end face of the jet, into which a sealing ring (136) can be inserted.

28. A manually actuatable treatment device as recited in one of the Claims 20 through 27, characterized in that head part (115) and feed channel (130) formed in it are made as a one-piece injection molded part, that chamber (120) is firmly connected to head part (115), and that jet (135) is removably attached to head part (115) or is made in one piece with it.

29. A manually actuatable treatment device as recited in one of the Claims 20 through 28, characterized in that a connector (140) is inserted into the end of feed channel (130) facing away from jet (135), said connector being connected by a hose (144) to a connector (147), which is arranged in chamber (120) and which cooperates with shut-off valve (110). /7

30. A manually actuatable treatment device as recited in one of the Claims 19 through 29, characterized by a device (102, 104, 106; 108) for density modulation of the pressure medium.

31. A manually actuatable treatment device as recited in Claim 30, characterized in that density modulation device (108) is a piezoelectric element, which can produce vibrations up into the ultrasonic region.

---

4 pages of figures attached.

Figure 1

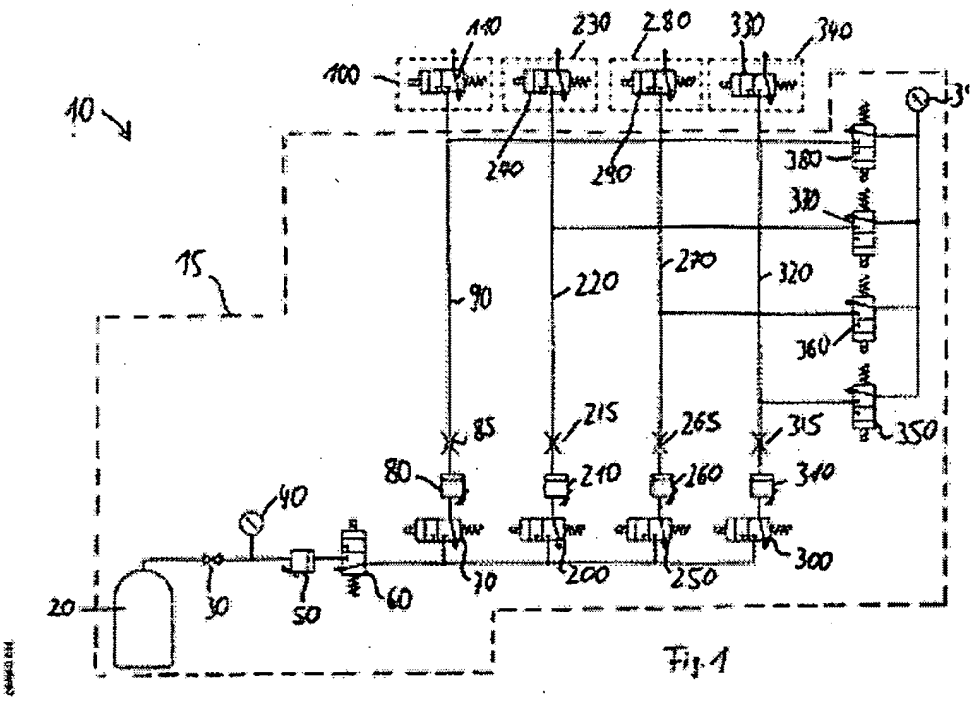


Fig. 1

Figure 2

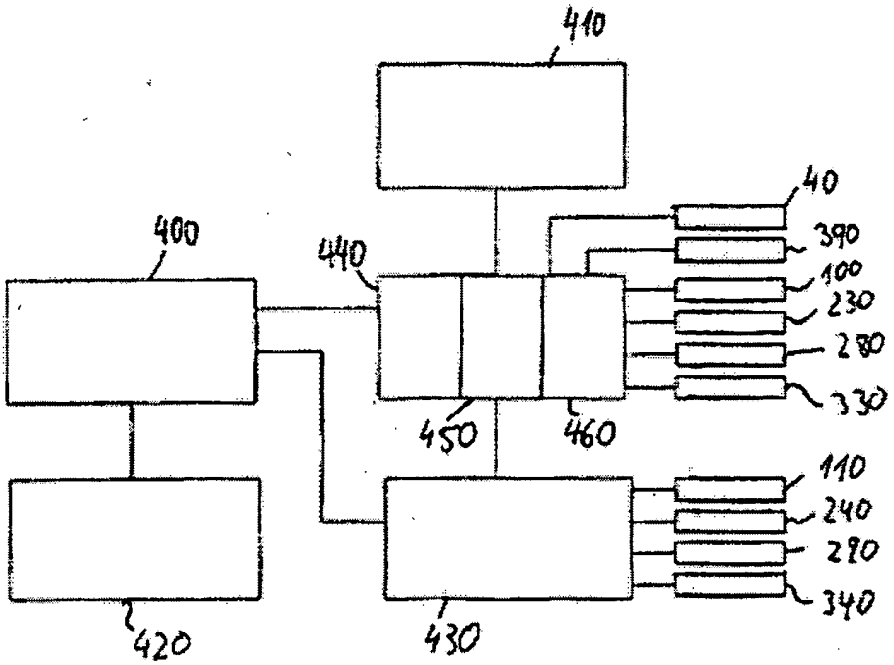

410
40
390
100
230
280
330
400
440
450
460
110
240
290
340
420
430

Figure 3

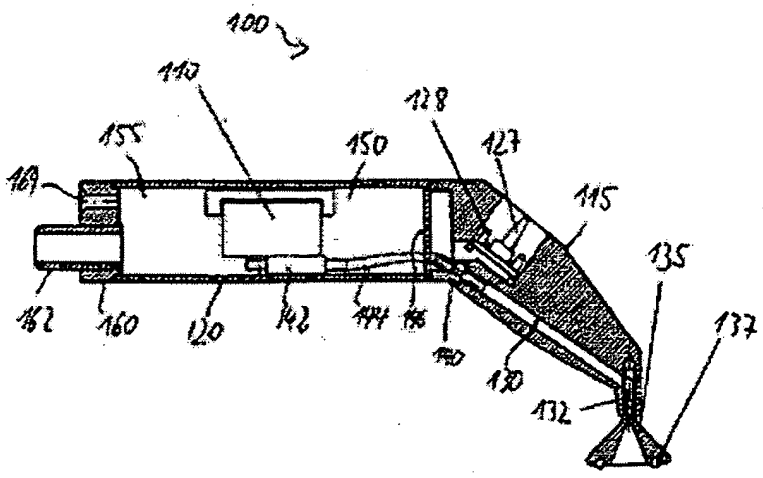

100
110
128
155
150
127
169
115
135
137
162
160
120
142
144
146
140
130
132

Figure 4.

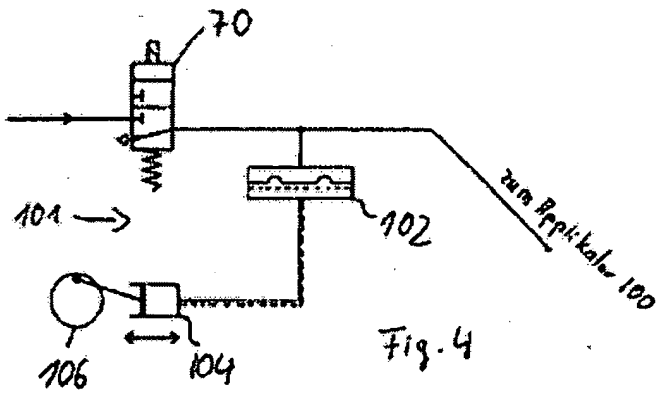
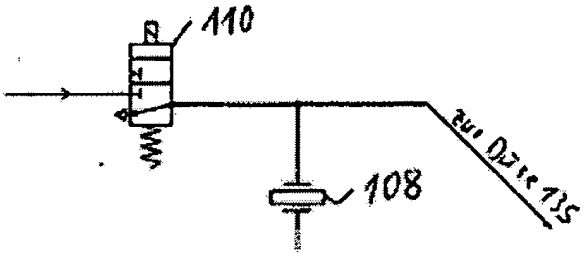


Fig. 4

Key: to applicator 100

Figure 5.



Key: to jet 135